

REMARKS

Pending Claims

Claims 1 and 4-46 are pending. Claims 2-3 are canceled. Claims 23-44 are withdrawn from consideration. Claims 1 and 45 are amended. Claim 46 has been added. The Applicant respectfully requests reconsideration of the pending claims in light of the claim amendments and arguments presented herein.

Rejections under 35 U.S.C. §102(b) as Being Anticipated by Haag:

Claims 1, 2, 5, 9-10, 12-16, 18, 22 and 45 are rejected under 35 U.S.C. §102 as being anticipated by U.S. Patent 6,093,293 to Haag et al. (hereinafter “Haag”).

Independent Claim 1

The Office Action states that Haag teaches a magnetron sputtering source that includes all the elements of independent claim 1. Independent claim 1 has been amended to recite an I-PVD source that includes a plurality of anode sections that are concentrically positioned in the chamber. Independent claim 1 has also been amended to recite a segmented magnetron cathode comprising a plurality of concentrically positioned magnetron cathode segments that are positioned in the chamber proximate to the concentrically positioned anode sections so that a respective one of the plurality of anode sections is positioned adjacent to a respective one of the plurality of magnetron cathode segments, where each of the plurality of concentrically positioned magnetron cathode segments is electrically isolated from each of the other concentrically positioned magnetron cathode segments.

Haag describes a magnetron sputtering source that has at least two mutually isolated stationary bar-shaped target arrangements mounted one alongside the other and separated by respective slits. Each target includes a respective electric pad so that it can be operated independently from the other target arrangement. The magnet arrangement can be controlled independently from each other.

To anticipate a claim under 35 U.S.C. §102, a single reference must teach every aspect of the claimed invention either explicitly or impliedly. Any feature not directly taught by the reference must be inherently present in the reference. Thus, a claim is anticipated by a reference only if each and every element of the claim is described, either expressly or inherently, in a single prior art reference.

Independent claim 1 as currently amended recites an I-PVD source with a concentric geometry. Claim 1 requires that the plurality of anode sections be concentrically positioned in the chamber. Also, claim 1 recites a segmented magnetron cathode comprising a plurality of concentrically positioned magnetron cathode segments that are positioned in the chamber proximate to the concentrically positioned anode sections so that a respective one of the plurality of anode sections is positioned adjacent to a respective one of the plurality of magnetron cathode segments.

The concentric anode and cathode geometry recited in independent claim 1 can provide a much more uniform coating on a substrate at a given level of plasma density than the bar-shaped target arrangements described in Haag because bar-shaped target arrangements have non-uniform magnetic fields at the edges of the bars. See, for example, Haag, FIG. 8 where the bar-

shaped target material is perpendicular to the longest dimension of the substrate holder 66. In such bar-shape target geometries, the film thickness distribution on the substrate under the edge of the bars is less than the film thickness distribution on the substrate under the middle of the bars. When electrical power on the bar-shaped magnetron is varied in order to increase or reduce the deposition rate, the changes in the deposition rate on the substrate under the center of the bar and on the substrate under the edge of the bar are different due to the different geometry of the magnetic fields. Haag shows apparatus with bar-shaped targets that are much longer than the substrate in order to compensate for edge effects.

In contrast, the I-PVD source with the concentric geometry claimed in independent claim 1 can separately control of the film thickness on the substrate under the center of the concentrically positioned magnetron cathode segments relative to the film thickness under the edges of the concentrically positioned magnetron cathode segments. Consequently, with this concentric design, the magnetron size can be equal to the size of the substrate, which reduces the cost and size of the apparatus.

The Office Action states, in connection with the 35 U.S.C. §103(a) rejection of claim 3, that Haag fails to disclose a concentric orientation of the cathode and the anode. However, the Office Action states that U.S. Patent No. 5,135,554 to Rogers (hereinafter “Rogers”) teaches an apparatus and method for sputtering wherein cathodes are located central to the workpiece. The Office Action refers to the cathodes 48, 50, and 52 in Rogers FIG. 3 and argues that it would be obvious for the anodes and cathodes of Haag to have the common central orientation taught by Rogers and that such an orientation is a matter of design choice.

The Applicant submits that Rogers does not teach the concentric geometry claimed in independent claim 1. In fact, the Office Action refers to a geometry with three separate conventional sputtering units 48, 50, and 52 that are located radially around the center of the chamber. Positioning separate and complete magnetrons around the center of a chamber in a radial geometry is not equivalent to a single magnetron with a concentric anode and cathode geometry. The Applicant submits that it is not a matter of design choice. Rather it is a different design that achieved different process goals.

Because the sputtering units 48, 50, and 52 are separate, but complete magnetrons, they do not have the capabilities of the claimed I-PVD source. For example, the user cannot independently control electrically isolated sections of the anode and cathode. Therefore, there is much less control over the uniformity of the resulting sputtered film. More specifically, the Rogers sputtering system does not include a plurality of concentrically positioned magnetron cathode segments that are positioned in the chamber proximate to the concentrically positioned anode sections so that a respective one of the plurality of anode sections is positioned adjacent to a respective one of the plurality of magnetron cathode segments.

In addition, independent claim 1 has been amended to recite an I-PVD source that includes a power supply that ignites and sustains a plasma comprising metal ions. None of the prior art references of record alone, or in combination, describes using the geometry recited in independent claim 1 as currently amended to ignite and sustain a plasma comprising metal ions from the concentrically positioned magnetron cathode segment material and the feed gas.

In light of the above arguments and amendment to independent claim 1, the Applicant submits that claim 1 is allowable over the prior art of record. In addition, the Applicant submits that dependent claims 4-22 are allowable as depending on an allowable base claim.

Independent Claim 45

Independent claim 45 has been amended to recite a plasma I-PVD source comprising a concentrically positioned segmented magnetron cathode that generates a plasma comprising metal ions from the concentrically positioned magnetron cathode segment material and the feed gas. As described in connection with rejection of claim 1, Rogers does not teach the claimed concentric cathode geometry. Also, none of the prior art references of record alone, or in combination, describes using the geometry recited in independent claim 1 as currently amended to ignite and sustain a plasma comprising metal ions. Thus, the Applicant submits that claim 45 is allowable over the prior art of record.

Rejections under 35 U.S.C. §103(a)

Claims 3 and 6 are rejected under 35 U.S.C. §103(a) as being unpatentable over Haag in view of Roger. Claim 4 is rejected under 35 U.S.C. §103(a) as being unpatentable over Haag in view of U.S. Patent No. 4,132,961 to Bergman. Claim 7 is rejected under 35 U.S.C. §103(a) as being unpatentable over Haag in view of U.S. Patent No. 5,616,225 to Sieck et al. Claim 8 is rejected under 35 U.S.C. §103(a) as being unpatentable over Haag. Claim 11 is rejected under 35 U.S.C. §103(a) as being unpatentable over Haag in view of U.S. Patent Publication U.S. 2002/0157964 to Hoffman. Claim 17 is rejected under 35 U.S.C. §103(a) as being unpatentable over Haag in view of U.S. Patent Publication US 2001/0050225 to Glocker. Claims 19-20 are

rejected under 35 U.S.C. §103(a) as being unpatentable over Haag in view of U.S. Patent No. 3,609,658. Also, claim 21 is rejected under 35 U.S.C. §103(a) as being unpatentable over Haag in view of U.S. Patent No. 5,410,425 to Rhodes.

Claim 3 has been canceled. In light of the amendments to independent claim 1 and the above arguments made in connection with the rejection under 35 U.S.C. §102(b), the Applicant submits that dependent claims 4, 6, 7, 8, 11, 17, 19-20, and 21 are allowable as depending from an allowable base claim.

New Claims

New claim 46 recites the plasma source of claim 1 wherein at least two of the plurality of magnetron cathode segments has an unbalance magnetic field that increases a density of the plasma and a density of the metal ions in the plasma. Claim 46 is supported by the originally filed specification. See, for example, FIG. 2C and paragraph 38, 49, and 56-61 of the published application.

CONCLUSION

Claims 1-46 are pending. Claims 1 and 45 have been amended. Claim 46 has been added. The Applicant respectfully requests reconsideration of the pending claims in light of the above arguments. The undersigned attorney would welcome the opportunity to discuss any outstanding issues, and to work with the Examiner toward placing the application in condition for allowance.

Respectfully submitted,

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Page 15

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